

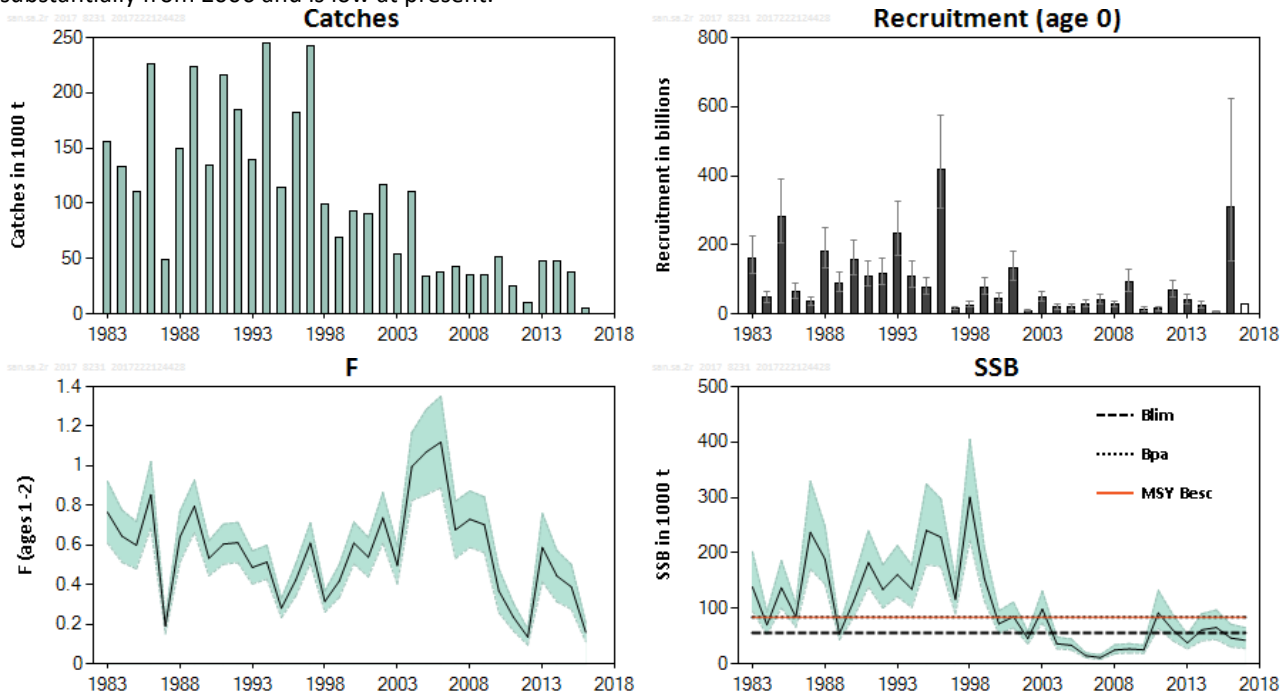
## Sandeel (*Ammodytes* spp.) in divisions 4.b-c and Subdivision 20, Sandeel Area 2r (central and southern North Sea)

### ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2017 should be no more than 175 941 tonnes.

### Stock development over time

The spawning-stock biomass (SSB) has been below the limit biomass level ( $B_{lim}$ ) in the last two years and below the precautionary reference points ( $B_{pa} = MSY_{Bescapement}$ ) for most of the years since 2000. Recruitment has been low since 2000; however, the 2016 year class is estimated to be one of the largest in the time-series. Fishing mortality (F) has declined substantially from 2006 and is low at present.



**Figure 1** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. Historical development of the stock from the summary of the stock assessment with 90% confidence intervals. Predicted values are not shaded.

### Stock and exploitation status

**Table 1** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. State of the stock and fishery relative to reference points.

		Fishing pressure			Stock size		
		2014	2015	2016	2015	2016	2017
Maximum sustainable yield	$F_{MSY}$	?	?	?	Unknown	$MSY_{Bescapement}$	✗ ✗ ✗ Below escapement
Precautionary approach	$F_{pa}, F_{lim}$	?	?	?	Unknown	$B_{pa}, B_{lim}$	⊙ ✗ ✗ Reduced reproductive capacity
Management plan	$F_{MGT}$	-	-	-	Not applicable	$SSB_{MGT}$	- - - Not applicable

## Catch options

**Table 2** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. The basis for the catch options.

Variable	Value	Source	Notes
F (2016)	0.128	ICES (2017a)	Sum of half-yearly Fs
Recruitment (2016)	311082270	ICES (2017a)	In thousands
Recruitment (2017)	27335216	ICES (2017a)	Geometric mean (2006–2015) in thousands
SSB (2017)	42569	ICES (2017a)	In tonnes

**Table 3** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. Annual catch options. All weights are in tonnes.

Basis	Total catch (2017)	F <sub>total</sub> (2017)	SSB (2018)	% SSB change *	% TAC change **
ICES advice basis					
SSB <sub>2018</sub> ≥ MSY B <sub>escapement</sub> with F <sub>cap</sub>	175941	0.44	260229	511	3419
Other options					
F = 0	0	0	370874	771	-100
F <sub>pa</sub>	Not applicable				
F <sub>lim</sub>	Not applicable				
SSB <sub>2018</sub> = MSY B <sub>escapement</sub> = B <sub>pa</sub>	479732	1.9	84000	97	9495
B <sub>lim</sub>	535275	2.4	56000	32	10606
F <sub>2016</sub> = F <sub>sq</sub>	57408	0.128	334347	685	1048

\* SSB 2018 relative to SSB 2017.

\*\* Catch option for 2017 relative to TAC in 2016.

## Basis of the advice

**Table 4** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. The basis of the advice.

Advice basis	MSY approach (Escapement strategy with F <sub>cap</sub> )
Management plan	ICES is not aware of any agreed precautionary management plan for sandeel in this area.

## Quality of the assessment

This stock was benchmarked in the period between the 2016 and 2017 assessments (ICES, 2017a). ICES statistical rectangles included in this sandeel area were changed.

Changes in stock area, assessment methodology, and input data cause a difference between the 2017 and historical results. The change in the assessment area, length of the dredge survey time-series, and expansion of the survey area allowed for the inclusion of fishery-independent information from a dredge survey. There is confidence in the above-average recruitment estimate for 2016 because the 2016 dredge survey shows, over a wide range of sandeel banks, large densities of age 0 sandeel that were not present in 2012–2015.

The dredge survey time-series in this area is still short (2010–2016) and the quality of the assessment will likely improve once a longer time-series becomes available.

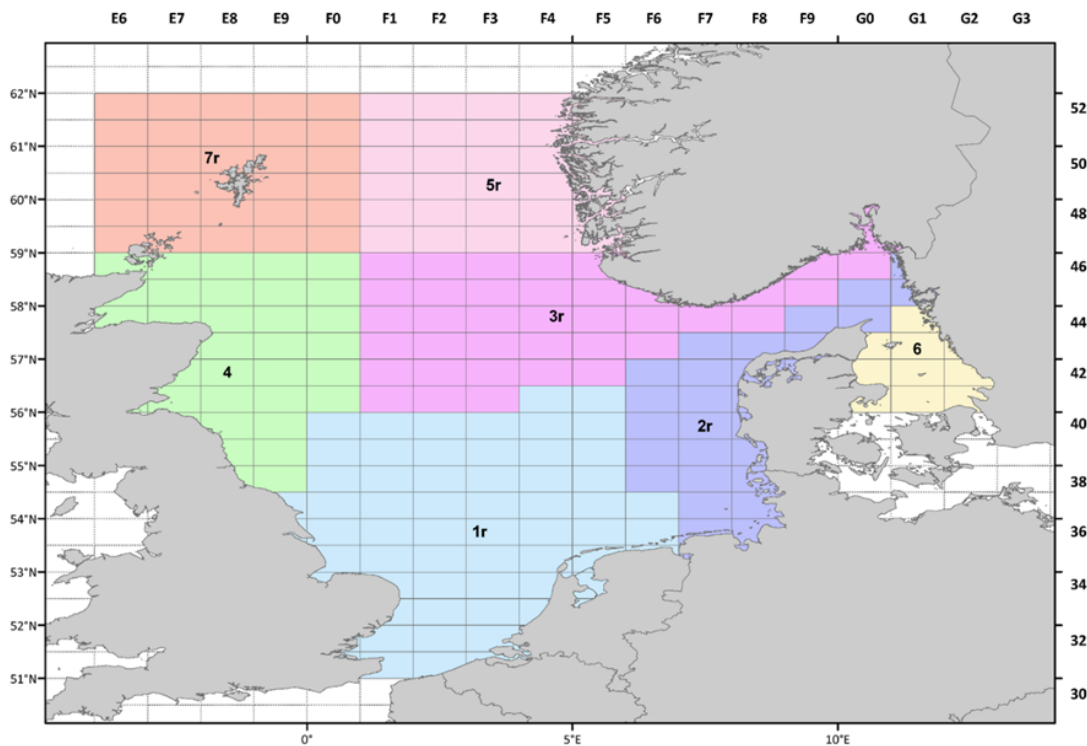


**Figure 2** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. Historical assessment results (final-year recruitment estimates included).

**Issues relevant for the advice**

In 2017 the name of this sandeel area was changed from Sandeel Area 2 to Sandeel Area 2r because of a change in the statistical rectangles included in the stock area (ICES, 2017a).

The SSB is estimated to be below  $B_{lim}$  at the beginning of 2017, but the incoming recruitment together with the advised catch will allow the SSB to increase above  $MSY B_{escapement}$  by 2018.



**Figure 3** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. Sandeel are largely sedentary after settlement and form a complex of local (sub-)stocks in the North Sea. To avoid local depletion, ICES advice for sandeel is provided separately for seven areas in Division 3.a and Subarea 4. Advice for sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r is defined by ICES statistical rectangles 35 F7-F8; 36 F7-F9; 37 F7-F8; 38-41 F6-F8; 42 F6-F9; 43 F7-F9; 44 F9-G0; 45 G0-G1; 46 G1. ICES revised this sandeel area by ICES statistical rectangle at the 2016 benchmark (ICES, 2017a).

## Reference points

**Table 5** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{\text{escapement}}$	84 000 t	$= B_{\text{pa}}$	ICES (2017a)
	$F_{\text{MSY}}$	Not defined		
	$F_{\text{cap}}$	0.44	Maximum F estimated from MSE that results in less than 5% probability of $SSB < B_{\text{lim}}$	ICES (2017a)
Precautionary approach	$B_{\text{lim}}$	56 000 t	Average SSB of the two lowest SSB estimates providing high recruitment (2001, 2009)	ICES (2017a)
	$B_{\text{pa}}$	84 000 t	$B_{\text{pa}} = B_{\text{lim}} \times \exp(\sigma \times 1.645)$ , with $\sigma = 0.25$ estimated from assessment uncertainty in the terminal year.	ICES (2017a)
	$F_{\text{lim}}$	Not defined		
Management plan	$SSB_{\text{MGT}}$	Not defined		
	$F_{\text{MGT}}$	Not defined		

## Basis of the assessment

**Table 6** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. The basis of the assessment and advice.

ICES stock data category	1 (see <a href="#">ICES, 2016</a> )
Assessment type	Analytical age-based (SMS-effort), seasonal (ICES, 2017b)
Input data	One survey index (dredge survey since 2010). Total international catch and fishing effort. Constant maturity-at-age from surveys. Natural mortality estimated from multispecies assessment (assumed constant over time). Age and length frequencies from catch sampling.
Discards and bycatch	Discarding is considered to be negligible.
Indicators	None
Other information	Last benchmarked in 2016 ( <a href="#">ICES, 2017a</a> ).
Working group	Herring Assessment Working Group ( <a href="#">HAWG</a> )

## Information from stakeholders

There is no available information.

## History of advice, catch, and management

**Table 7** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. History of ICES advice, the agreed TAC, and ICES estimates of catch. All weights are in tonnes. Values of catch for the period 2005 to 2015 are presented to the nearest thousand tonnes.

Year	ICES advice	Catch corresponding to advice	TAC	ICES catch SA 2	ICES catch SA 2r	Total ICES catch (SAs 1r–7r)
2005*	Exploitation to be kept below the level of 2003. Adjustment to be made conditional on the abundance of the 2004 year class.	-	661000**	41000		177000
2006*	The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2007.	-	300000**	35000		293000
2007*	The fishery should remain closed until information is available which assures that the stock can be rebuilt to $B_{pa}$ by 2008.	-	173000**	6000		230000
2008*	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2009.	-	375000**	13000		348000
2009*	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2010.	-	377000**	10000		353000
2010*	The fishery should only be allowed if monitoring information is available and shows that the stock can be rebuilt to $B_{pa}$ by 2011.	-	377000**	32000		414000
2011	MSY approach: allow for sufficient stock (MSY $B_{escapement}$ ) to remain for successful recruitment.	< 34000	34000	30000		438000
2012	Catches for monitoring purposes should not exceed 5 000 t.	< 5000	5000	8000		102000
2013	MSY approach: allow for sufficient stock (MSY $B_{escapement}$ ) to remain for successful recruitment.	< 17544	18000	23000		278000
2014	Catches for monitoring purposes should not exceed 5 000 t.	< 5000	5000	8900		264000
2015	MSY approach: allow for sufficient stock (MSY $B_{escapement}$ ) to remain for successful recruitment.	< 29000	29000	21000		312000
2016	Catches for monitoring purposes should not exceed 5 000 t.	≤ 5000	5000	4037***	9238***	73420***
2017^	MSY approach: allow for sufficient stock (MSY $B_{escapement}$ ) to remain for successful recruitment.	≤ 175941				

\* Advice for Subarea 4, excluding the Shetland area.

\*\* Set for EU waters of divisions 2.a and 3.a and Subarea 4.

\*\*\* Preliminary.

^ ICES statistical rectangles included in this sandeel area have changed in the 2017 assessment and advice.

## History of catch and landings

**Table 8** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. Catch distribution by fleet in 2016 data as estimated by ICES (in tonnes).

Total catch (2016)	Landings	Discards
9238	100% industrial trawl fisheries 9238	Negligible

**Table 9** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. History of total catch (in tonnes) as estimated by ICES.

Year	Catch
1982	138899
1983	156208
1984	133398
1985	111889
1986	225581
1987	49067
1988	151543
1989	227292
1990	133796
1991	215565
1992	184241
1993	147964
1994	244944
1995	122155
1996	186460
1997	242680
1998	100425
1999	63165
2000	100336
2001	84682
2002	117557
2003	44504
2004	116767
2005	34568
2006	37768
2007	43402
2008	35120
2009	36709
2010	51635
2011	24897
2012	12552
2013	47847
2014	65084
2015	37899
2016	9238

### Summary of the assessment

**Table 10** Sandeel in divisions 4.b-c and Subdivision 20, Sandeel Area 2r. Assessment summary. The SSB is estimated for 1 January. Yield values used for the assessment do not include catches of age 0 in the first half of the year and, hence, may differ slightly from the ICES catch estimates presented in other tables.

Year	Recruitment	High	Low	SSB	High	Low	Total catch	F per year	High	Low
	Age 0			tonnes			tonnes	Ages 1–2		
	thousands									
1983	162210394	223649584	117649277	138790	202365	95188	155664	0.77	0.92	0.61
1984	47524155	66025479	34207178	70349	93331	53026	133343	0.65	0.78	0.51
1985	283208869	390432765	205431692	137210	186348	101029	110546	0.60	0.72	0.48
1986	62860361	87666056	45073603	84618	108115	66228	225470	0.85	1.02	0.69
1987	35719292	49672310	25685695	237330	329293	171050	49070	0.191	0.23	0.152
1988	180974598	248906028	131583013	189280	248938	143919	149466	0.64	0.77	0.51

Year	Recruitment	High	Low	SSB	High	Low	Total catch	F	High	Low
	Age 0			tonnes			per year			
	thousands							Ages 1–2		
1989	87403281	121485635	62882608	54354	68109	43377	223507	0.80	0.93	0.66
1990	156277249	215284954	113443035	114250	153754	84896	133874	0.53	0.62	0.45
1991	109695820	152340639	78988594	182640	240166	138893	215508	0.61	0.71	0.50
1992	116143936	160921811	83825889	134100	178483	100754	184033	0.61	0.71	0.51
1993	234423134	325459961	168850895	160810	213337	121216	139826	0.49	0.57	0.40
1994	108300675	152160044	77083549	134610	178082	101750	244939	0.51	0.60	0.43
1995	76458018	106710281	54782243	240680	324480	178522	113899	0.28	0.33	0.23
1996	419659987	573400014	307140740	228490	297625	175414	182562	0.43	0.51	0.34
1997	15489737	21837687	10987059	116640	151632	89723	242094	0.61	0.71	0.51
1998	26492877	36999693	18969685	300600	404644	223308	99813	0.32	0.37	0.26
1999	76153850	104629086	55428266	154070	209231	113451	69427	0.42	0.50	0.34
2000	43578378	60358634	31463187	72259	95518	54664	92908	0.61	0.72	0.51
2001	131607033	179510187	96487065	85279	111574	65181	90199	0.54	0.64	0.44
2002	10037427	13994671	7199165	45634	57785	36038	117388	0.74	0.87	0.61
2003	47638656	65467722	34665045	98693	131662	73980	53710	0.50	0.59	0.40
2004	19021031	26678446	13561495	36347	48481	27250	110546	1.00	1.17	0.83
2005	19225977	27215903	13581698	33563	44710	25195	34396	1.07	1.29	0.86
2006	27624463	38737767	19699405	14748	19977	10888	37860	1.12	1.35	0.89
2007	40632978	56879395	29027012	11420	16531	7889	43090	0.68	0.82	0.53
2008	26910064	38307624	18903588	25114	34463	18301	35604	0.73	0.87	0.59
2009	92039136	129950541	65187897	26811	36414	19740	35687	0.70	0.84	0.56
2010	13035357	19899808	8538803	25341	33790	19005	51670	0.37	0.48	0.26
2011	14851562	21013543	10496511	92034	132439	63956	24896	0.24	0.31	0.17
2012	69910406	96752034	50515371	61079	89086	41877	10595	0.135	0.175	0.095
2013	39232891	56112146	27431133	37945	53327	27000	47814	0.59	0.76	0.42
2014	24830981	37350571	16507850	61324	90456	41574	48033	0.44	0.57	0.31
2015	6354476	10387159	3887431	65401	97212	44000	37902	0.39	0.50	0.28
2016	311082270	624075129	155064950	46578	71362	30402	4903	0.159	0.21	0.112
2017	27335216*			42569**	65446	27689				
Avg	90398414	133537450	64536195	101742	137662	75325	104419	0.57	0.68	0.45

\* Geometric mean (2006–2015).

\*\* Using mean weight-at-age from 2012 to 2016.

## Sources and references

ICES. 2016. General context of ICES advice. *In* Report of the ICES Advisory Committee, 2016. ICES Advice 2016, Book 1, Section 1.2.

ICES. 2017a. Report of the Benchmark Workshop on Sandeel Stocks (WKSAND), 31 October–4 November 2016, Bergen, Norway. ICES CM 2016/ACOM:33.

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